Space Weather Technical Forecast

Issued on Tuesday, 01 November 2022 at 00:18 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Chance of G1/Minor Storms days 3 and 4 (3 and 4 Nov). Ongoing Active electron fluence.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been low over the last 24 hours, with minor low level C-class flares observed. There are currently two Active Regions on the visible disc. AR3135, is the largest region with well-developed leading and trailing spots. AR3131 is a single large spot with some minor trailing spots and pores. Three other unnumbered regions are small and inactive currently, with two observed on the eastern hemisphere and the remaining one on the western. No Earth-directed coronal mass ejections have been observed.

Solar Wind / Geomagnetic Activity: The solar wind, observed by DSCOVR at L1, has remained fairly stable, with a slight declining trend from around 520 km/s to currently around 420km/s. This is indicative of the waning fast wind of CH37 which the Earth has been connected to during recent days. Density was around average or slightly above. Total interplanetary magnetic field strength was weak below 7nT throughout. The north-south component, Bz, was also weak with values between +4/-7 nT. Phi angle was predominantly positive (away from the Sun). Geomagnetic activity was Quiet to Unsettled (Kp 2-3).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) as measured at GOES-16 has remained at background levels. High energy electron flux (greater than 2MeV) at GOES-16 was at mostly high levels, with a peak of 4920pfu at 31/1755 UTC, before becoming Moderate around 31/2000 UTC. Electron Fluence levels were above the Active threshold with a peak value of 1.58e8 integrated pfu observed at 01/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to be Low, with a slight chance of an isolated M-class flare.

Solar Wind / Geomagnetic Activity: No Earth-directed CMEs are forecast. The Earth is currently experiencing slightly elevated solar winds, under the influence of the high speed stream (HSS) from positive coronal hole 37. During day 1 (1 Nov), Earth will likely transition into the HSS related to CH38 with solar winds perhaps reaching elevated levels of around 500-550 km/s. Earth will then likely transit out of the fast wind of CH38 on day 2 (2 Nov) with a likely slow decline in solar speeds before the fast wind from CH39 arrives probably late on day 3 (3 Nov) or during day 4 (4 Nov). Geomagnetic activity will likely be Quiet to Unsettled (Kp 2-3) throughout the period, with a chance of Active or G1/Minor Storm intervals (Kp 4-5) on days 3 and 4 (3 and 4 Nov).

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10MeV) observed by GOES-16 is expected to be at background levels. High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at moderate to high levels. The associated

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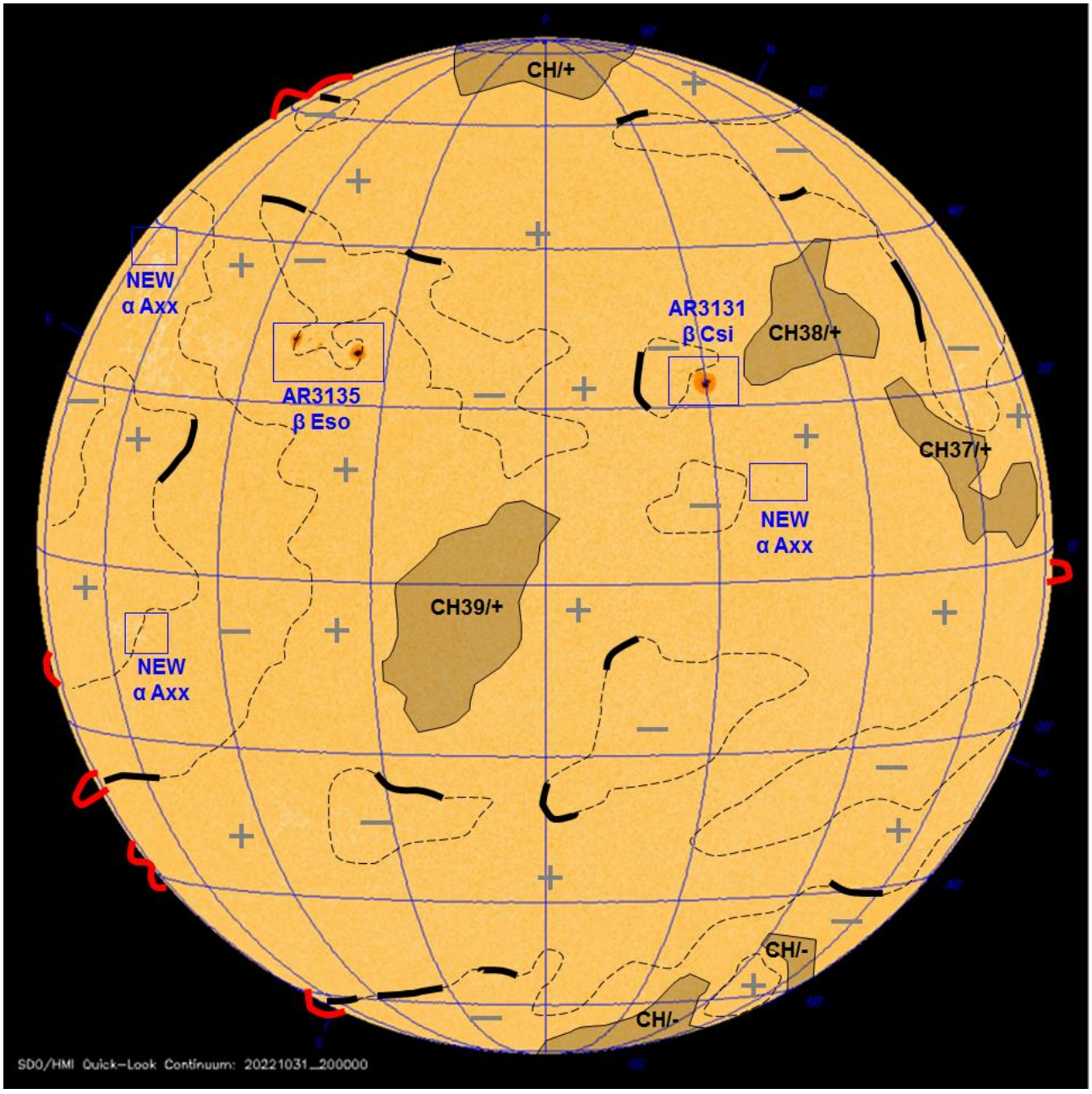
24 hour electron fluence will probably continue just above the Active (1e8 integrated pfu) threshold.

Figure 1. Solar Analysis Valid 2000 UTC, 31 October 2022.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No Earth-directed CMEs are forecast.

The Earth is currently under the influence of the high speed stream (HSS) related to the positive coronal hole 37, which is now nearing the western limb, and this is giving solar winds around 420km/s with a slight and erratic downwards trend. During day 1 (1 Nov), Earth will likely transition into the HSS related to positive coronal hole 38. Based on observations from the last rotation, speeds of around 500-550 km/s were observed. There is a slight chance that solar wind speeds may peak a little higher to Strong levels (600-650 km/s) for a time, though this is uncertain. Earth will then likely transit out of the fast wind of CH38 early during day 2 (2 Nov) with a likely decline in wind speeds before the HSS related to positive coronal hole 39 arrives, probably late on day 3 or during day 4 (3 or 4 Nov).
Geomagnetic activity will likely be Quiet to Unsettled (Kp 2-3) throughout much of the period, with a chance of Active or G1/Minor Storm intervals (Kp 4-5) on days 3 and 4 (3 and 4 Nov)) due to the fast wind arrival of CH39.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	5	5	20	40
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

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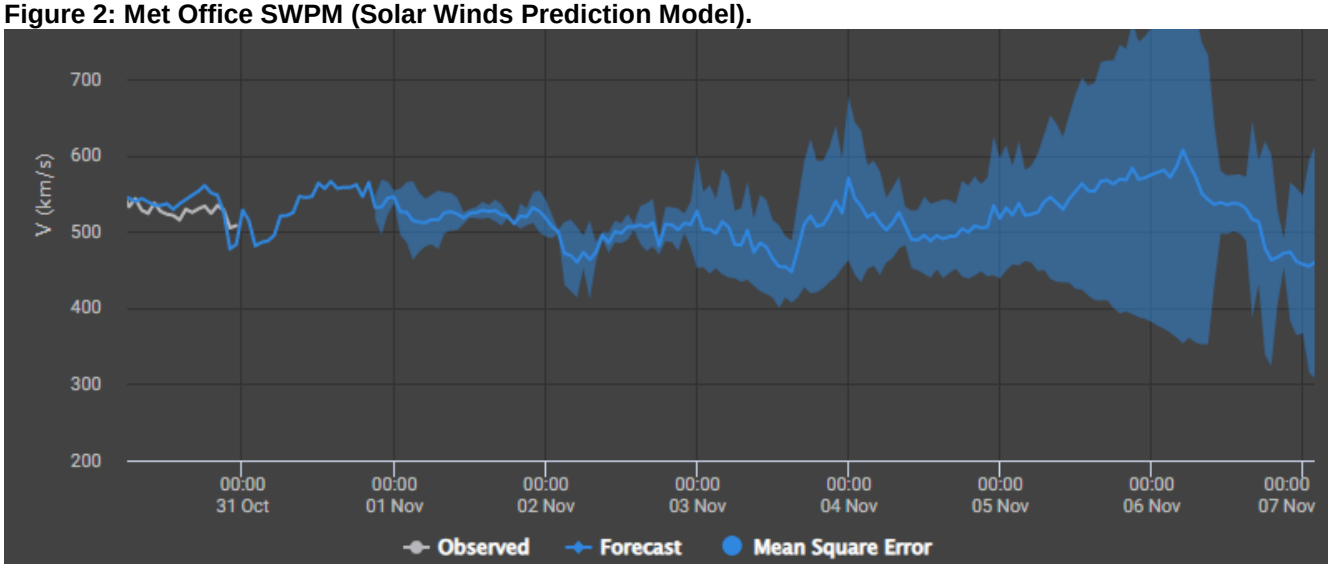
Figure 2: Met Office SWPM (Solar Winds Prediction Model).



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Radio Blackouts - X-Ray Flares:

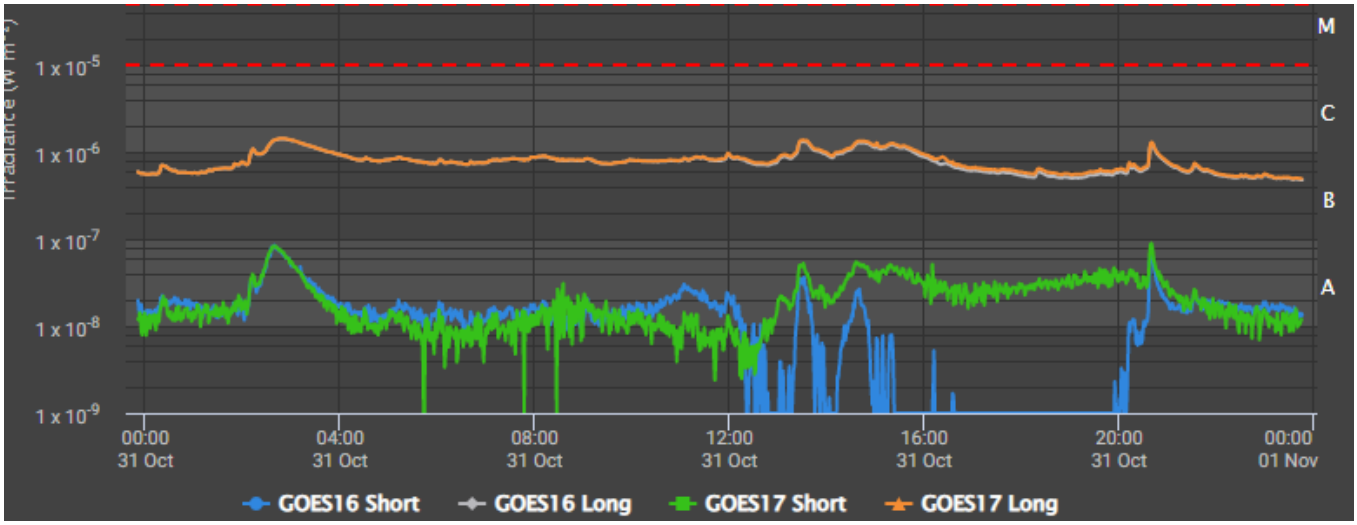
Appearing on the visible disc presently are two numbered Active Regions with AR3135 equal largest region with well-developed leading and trailing spots. AR3131 is of similar size and presents itself as a large single spot ith some minor trailing spots with a Csi/Beta configuration. Two other unnumbered regions on the eastern hemisphere with one unipolar in the north and a bipolar region in the south. The remaining third unnumbered region is on the northwest quadrant as a unipolar feature

GONG far-sided imagery indicates a number of regions are forecast to rotate onto the visible disc from across the eastern limb through the forecast period, and this could further increase risk values.

Solar activity is likely to be Low, with a slight chance of Moderate activity, mainly concentrated in the developing regions in the northeast quadrant.

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	10	20	20
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: X-ray flux plot at GEO showing a few Class flares in the past 24 hours.



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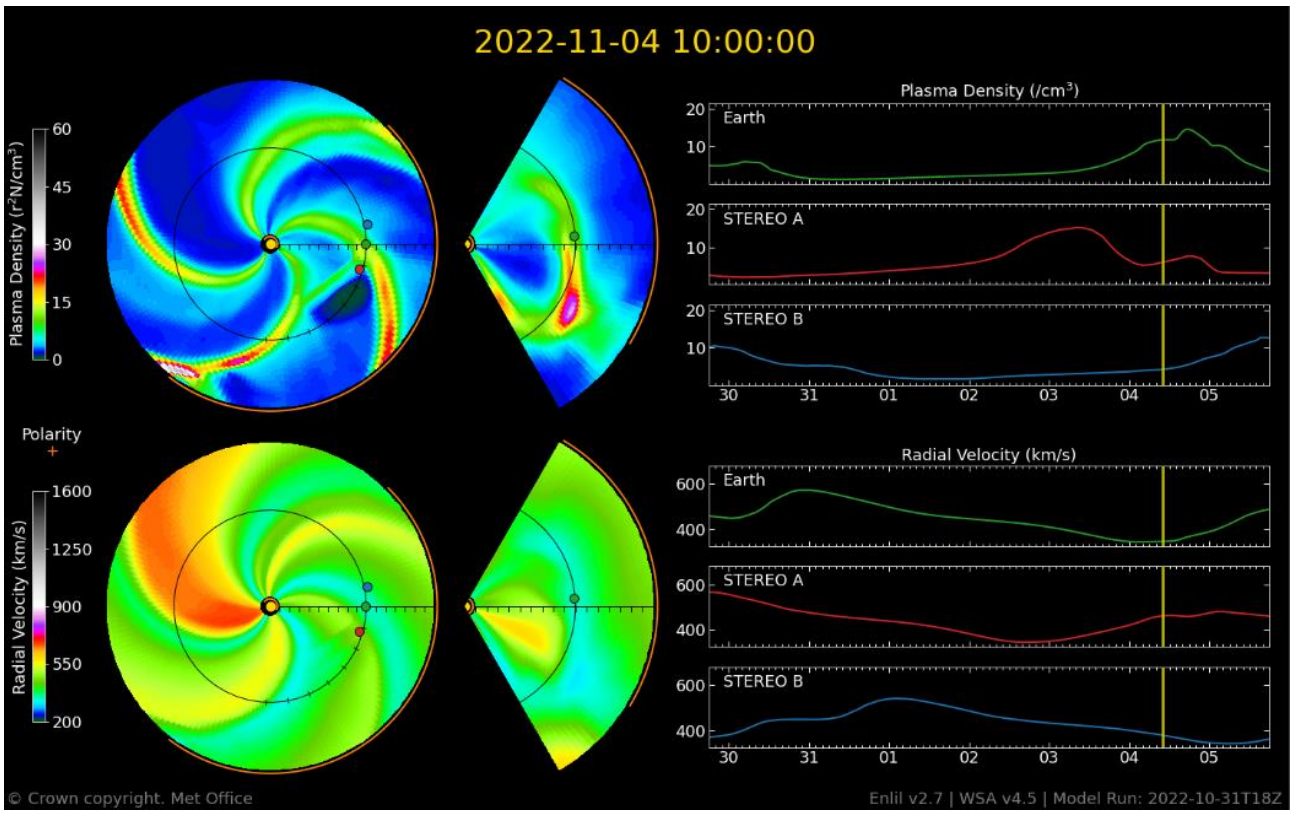
Solar Radiation Storms - (High Energy Protons):
The high energy proton flux (greater than 10 MeV) at GEO, observed by GOES-16 is currently at background and is forecast to remain at this level through the guidance period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Figure 4: Met Office ENLIL output showing arrival of HSS on day 4 (4 Nov).



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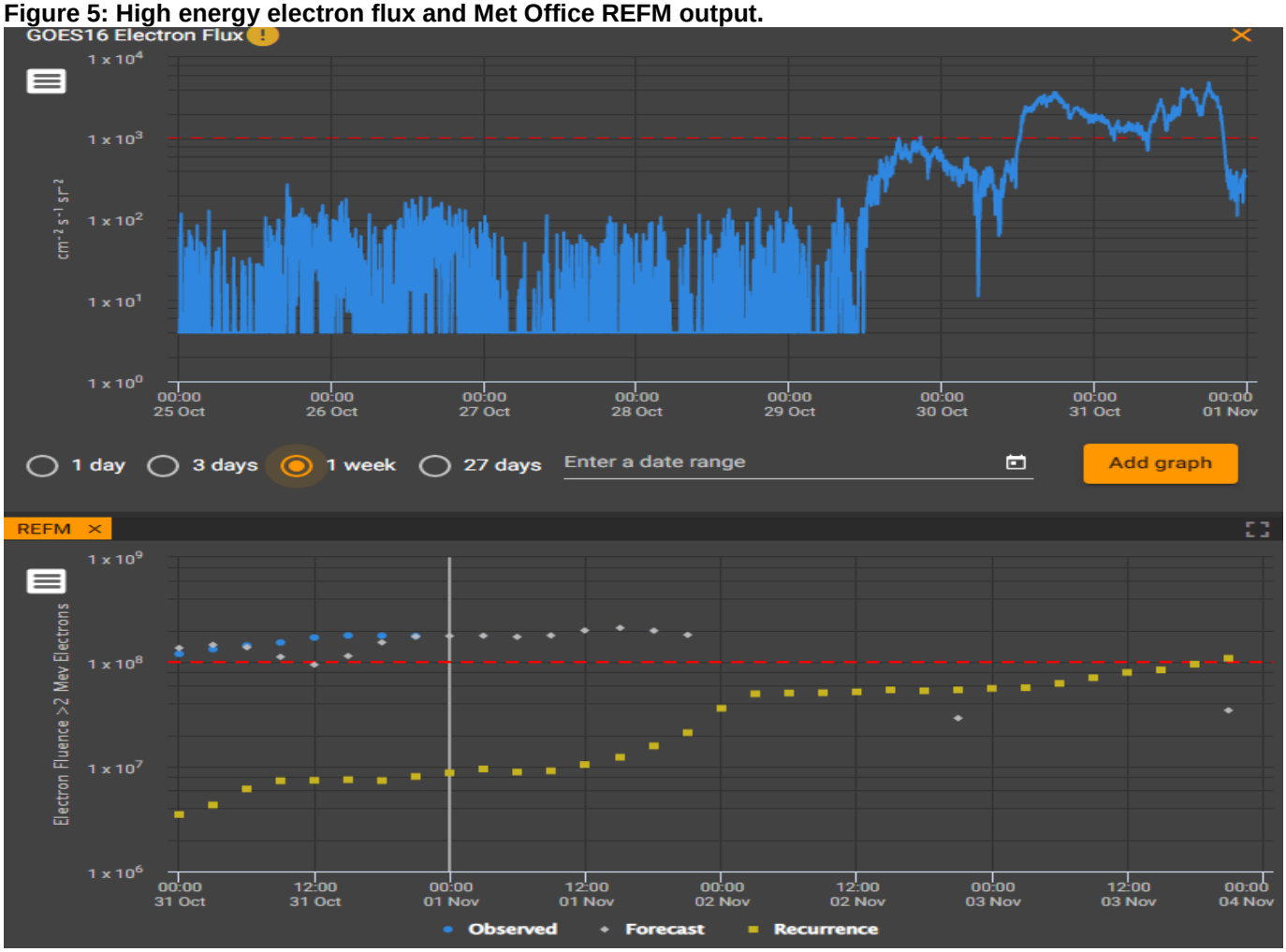
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) observed by GOES-16 is forecast to be at moderate to high levels

The associated 24 hour electron fluence is likely to remain just above the Active (1e8 integrated pfu) threshold for much of the period, although a dip is probable due to the arrival of the HSS from CH39 on days 3 and 4 (3 and 4 Nov) and the natural waning effects of the electron fields, confidence also declines with time. Recurrence favours the elevated electron flux and fluence values for several days, though persistence shows on previous rotation the Active fluence threshold was not reached. The Met Office REFM output also shows good guidance for Active electron fluence initially, with a waning trend.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	100	80	70	40
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	5	3	1	1

Figure 5: High energy electron flux and Met Office REFM output.



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